

# METHOD FOR TRANSMITTING AND RECEIVING MESSAGE OF SHORT MESSAGE BROADCASTING SERVICES IN TELECOMMUNICATION SYSTEM

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present invention relates to mobile communication services, and more particularly to a method for transmitting and receiving short message broadcasting services in a code division multiple access communication system.

### Description of the Related Art

Short Message Service (SMS) procedure for a code division multiple access (CDMA) system includes transmitting broadcast messages from a Short Message Service Center (SMSC) to mobile stations through a base station (BS), and receiving the broadcast messages transmitted from the BS at a mobile station MS. Generally, the BS transmits broadcast messages to a MS through two forward channels, namely a paging channel and a broadcast channel. A MS receiving the SMS chooses the messages from among the transmitted broadcast messages.

The BS may transmit broadcast messages using one of various transmitting methods such as a multi-slot broadcast transmission, a multi-slot broadcast paging or a periodic broadcast paging. Of these methods, the multi-slot broadcast message transmission is the simplest, causing the least amount of delay in transmission, and is used regardless of whether a periodic broadcast paging transmission is available. In the multi-slot broadcast message transmission, broadcast messages are transmitted from a BS to MSs within the service region of the BS through all slots of a control channel. However, because the broadcast messages are transmitted using all slots of the control channel, an overload of the control channel may occur, thereby impeding transmission of messages

other than the broadcast messages.

On the other hand, the multi-slot broadcast paging is used when the periodic broadcast paging is unavailable. In this method, a general paging message of a relatively small size, which indicates a forthcoming transmission, is first transmitted to MSs through all slots of the control channel before transmitting a broadcast message of a large size.

However, the periodic broadcast paging is a more efficient method than the multi-slot broadcast transmission as well as the multi-slot broadcast paging methods. In the periodic broadcast paging, a BS gives a notice to MSs of the periodic transmission of broadcast messages before periodically transmitting the broadcast messages. Particularly, a BS first transmits a general page message including a broadcast page information in every first slot of a broadcast cycle. Thereafter, a MS can determine the type and time of the message transmission based on the broadcast page and receive broadcast messages in consecutive slots of the broadcast cycle.

A detailed explanation of the periodic broadcast paging, which is most commonly used by communication systems including the CDMA, will follow. However, a description of a common control channel will first be provided. The common control channel is a channel used when a BS transmits an overhead information required for the operation of a MS as well as a general paging message for paging a MS.

Generally, the common control channel is a paging channel or a broadcast channel, but for purposes of explanation, the operation of the common control channel will be discussed with respect to the paging channel. However, such operations can also be performed through a broadcast channel.

Fig. 1 shows a general configuration of a paging channel for the SMS. As shown in Fig. 1, a BS loads and transmits broadcast messages in a slot of 80ms, where each slot recurs in every 2048

slot of the paging channel with respect to the system time. The slot (SLOT\_NUM) at which a broadcast message is transmitted can be calculated by Equation 1 below, where 't' represent a system time for each frame of the paging channel.

$$[1] \quad \text{SLOT\_NUM} = \lfloor t/4 \rfloor \bmod 2048$$

A MS remains in a non-active state and becomes active to receive broadcast messages transmitted in the 80ms slot of the paging channel. Upon receipt of the messages, the MS returns back to the non-active or idle state. The periodic broadcast paging method in the related art will next be discussed with reference to Fig. 2.

Referring to Fig. 2, a BS transmits broadcast page information in every first slot of a broadcast cycle and transmits broadcast messages in subsequent slots of the broadcast cycle to MSs. A MS which is configured to receive SMS broadcast message then receives the broadcast messages based on broadcast page(s) by periodically monitoring every first slot of the broadcast cycle to receive the broadcast page information. Here, the maximum interval of the broadcast cycle (M) can be calculated by Equation 2, where 'i' represents a maximum slot cycle index (MAX\_SLOT\_CYCLE\_INDEX) field value of a system parameter message transmitted to a MS through the paging channel..

$$[2] \quad M = 2^i \times 16, 0 \leq i \leq 7$$

Accordingly, based upon the broadcast cycle M, a BS transmits broadcast page information

through a first slot of a broadcast cycle, where the slot number is calculated by Equation 3 below. In other words, the BS transmits Broadcast Pages 1, 2, and 3 through the first slot a broadcast cycle, which is indicated as '0' in the paging channel shown in Fig. 2.

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$$[3] \quad \lfloor t/4 \rfloor \bmod M = 0$$

Each broadcast page transmitted through the first slot as described above, includes at least one broadcast address (BC\_ADDR), where each BC\_ADDR includes information regarding a broadcast message. As shown in Fig. 2, the first broadcast page would include two broadcast addresses corresponding to the first broadcast message in slots 3 and 4, the second broadcast page would include a broadcast address corresponding to the second broadcast message in slot 6, and the third broadcast page would include three broadcast addresses corresponding to the third broadcast message in slots 9~11. Thus, a BS periodically transmits broadcast page(s) in the first slot and broadcast messages in subsequent slots of the broadcast cycle, after notifying MSs of its broadcast cycle through a system parameter message of the paging channel.

Here, a broadcast index field (BCAST\_INDEX) of an expanded system parameter message is used. Namely, a value of BCAST\_INDEX is set as 'i, (1 ≤ i ≤ 7)' when the BS is providing a SMS and '0' otherwise. If the value of the BCAST\_INDEX is set as 'i,' the broadcast cycle in which the broadcast message is transmitted can be calculated using Equation 4.

$$[4] \quad B = 2^i \times 16, 1 \leq i \leq 7$$

After the value of B is obtained by Equation 4, the broadcast message is transmitted by a broadcast cycle of (B+3) and the first slot of the broadcast cycle can be calculated by Equation 5.

$$[5] \quad \lfloor t/4 \rfloor \bmod M(B+3) = 0$$

When broadcast messages are periodically transmitted through a paging channel, a MS must also periodically monitor the assigned paging channel. Thus, a MS receives the transmitted broadcast page(s) from the BS through the first slot of the broadcast cycle and if several broadcast addresses (BC\_ADDR) are included in the broadcast page(s), the MS checks the subsequent slots to receive the necessary broadcast message.

In the CDMA system of the related art for the SMS, the broadcast index field BCAST\_INDEX of the expanded system parameter message is used only to set the state of a broadcast cycle and thus the SMS on or off. As a result, a BS cannot notify MSs that there is no broadcast message transmitted during certain broadcast cycles. Thus, a MS has to periodically monitor the common control channel to receive broadcast messages from a BS. Accordingly, a MS must periodically check the common control channel for at least every 80ms, even when there are no messages transmitted from a BS. This unnecessarily wastes the power consumption of a MS.

#### SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to solve at least the problems and disadvantages of the related art.

Another object of the present invention is to provide a more efficient method for transmitting



base station; periodically checking, at the mobile station, a corresponding common control channel when the current broadcast message will be transmitted; and receiving, at the mobile station, a corresponding broadcast message along with periodically checking the channel transmitted the broadcast message.

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### BRIEF DESCRIPTION OF THE DRAWING

The invention will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

Fig. 1 shows a paging channel for a SMS;

Fig. 2 shows a paging channel to explain a periodic broadcast paging method in the related art;

Fig. 3 and 4 show a paging channel for a broadcast message transmitting and receiving method according to the present invention;

Figs. 5 to 7 show a quick paging channel to explain a SMS according to the present invention; and

Fig. 8 shows a partial field of an expanded system parameter message according to the present invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Generally, the present invention transmits a broadcast indicator to a mobile station through a quick paging channel (QPCH) to notify

the MS whether a base station is transmitting a broadcast message through a control channel. As in the related art, the control channel may be either a paging channel or a broadcast channel, but for purposes of explanation, the present invention will be discussed with respect to the paging channel.

Fig. 3 shows a paging channel for transmitting and receiving SMS according to the present invention. Also, Fig. 4 is an enlarged diagram of the paging channel of Fig. 3 and Fig. 5 shows a configuration of the QPCH to explain the SMS according to the present invention. Namely, the present invention additionally uses a QPCH\_BI\_SUPPORTED field in an expanded system parameter message. The QPCH\_BI\_SUPPORTED field is used to notify whether a BS provides a broadcast indicator to a MS.

Referring to Fig. 3, as in the CDMA mobile communication system in the related art, a BS loads and transmits broadcast message(s) in the 80ms slot intervals of a broadcast cycle. However, in the present invention, a broadcast indicator as well as a paging indicator and a configuration change indicator are also periodically transmitted in an 80ms interval to the MS through the QPCH, before transmitting the broadcast message(s), as shown in Figs. 4 and 5. In the preferred embodiment, the indicators are transmitted 100ms prior to transmitting the broadcast messages.

As in the related art, the broadcast cycle has a period of 2048 where each slot recurs in every 2048 slot of the paging channel with respect to the system time and the slot number SLOT\_NUM in which a broadcast message is transmitted can be calculated by Equation 1. Similarly, a value of the maximum slot cycle index MAX\_SLOT\_CYCLE\_INDEX field of the system parameter message is transmitted to the MS through the paging channel from the BS before periodically transmitting the broadcast message(s) and is used to calculate the maximum broadcast cycle M by Equation 2 above.



Accordingly, the BS transmits the broadcast page information through the first slot of the broadcast cycle as calculated by Equation 3 based upon the maximum broadcast cycle M.

Also, the broadcast page information transmitted through the first slot of the broadcast cycle includes at least one broadcast addresses (BC\_ADDR), where a BC\_ADDR includes information regarding the broadcast message. Thereafter, the BS periodically transmits broadcast messages in subsequent slots corresponding to the broadcast address(es) in the broadcast cycle.

Furthermore, as in the related art, a broadcast index field BCASE\_INDEX of an expanded system parameter message is used, where a value of BCASE\_INDEX is set as 'i, ( $1 \leq i \leq 7$ )' when a BS provides a SMS and '0' otherwise. If the value of the BCASE\_INDEX using 3 bits is set as 'i,' the broadcast cycle in which the broadcast message is transmitted can be calculated using Equation 4. After the value of B is obtained by Equation 4, a broadcast message can be transmitted by a broadcast cycle of (B+3) and the first slot of a broadcast cycle can be calculated by Equation 5.

According to the present invention, however, a BS may provide a broadcast indicator and a QPCH\_BI\_SUPPORTED field to MSs to notify that the BS is transmitting broadcast message(s). If a BS provides a broadcast indicator to MSs, the QPCH\_BI\_SUPPORTED of the expanded system parameter message would be set to a value of "1" to notify an existence of a broadcast indicator, and otherwise to a value of "0". Here, the value of QPCH\_BI\_SUPPORTED may alternatively be set to "0" to notify the existence of a broadcast indicator and to "0," otherwise.

The broadcast indicator which notifies an existence of a broadcast message is included and transmitted through the QPCH, where the QPCH is transmitted 100ms prior to the transmission of a paging channel slot including a broadcast message. Moreover, the QPCH includes and transmits the paging indicator and a configuration change indicator as well as the broadcast indicator.

Particularly, the broadcast indicator may be inserted and transmitted in a reserved region of the QPCH. A MS then temporarily stores the QPCH\_BI\_SUPPORTED field value of the expanded system parameter message from the BS in a memory device. If a MS in a non-active state is configured to receive a broadcast message, such MS would periodically monitor the first slot of the paging channel in every broadcast cycle.

However, if the QPCH\_BI\_SUPPORTED field value of the extended system parameter message is set to '1' and if a MS is configured to receive a broadcast indicator, such MS would check the QPCH transmitted 100ms before each slot of the paging channel in the broadcast cycle to determine the broadcast indicator value. Thus, if the QPCH\_BI\_SUPPORTED field value is set to "1" and the broadcast indicator is also set to "1," a MS would determine that a broadcast page information and broadcast message(s) is transmitted through the paging channel and would monitor the paging channel to receive the necessary messages.

If the QPCH\_BI\_SUPPORTED field value is set to "1" while the broadcast indicator is set to "0," a MS would enter into an idle state without monitoring the paging channel.

If the "QPCH\_BI\_SUPPORTED" field value is set to "0," a MS would periodically monitor the first slot of the paging channel for every broadcast cycle as in the related art, and would receive the broadcast page information from the BS. Furthermore, if several broadcast addresses (BC\_ADDR) are included in the broadcast page information, a MS would monitor the subsequent slots to receive the necessary broadcast message.

Fig. 6 shows the QPCH of Fig. 5 when the data rate is 4800bps and Fig. 7 shows the QPCH of Fig. 5 when the data rate is 9600bps. Namely, Figs. 6 and 7 show configurations of the QPCH of Fig. 5 in which 1, 2 or 4 bits are used for transmitting the broadcast indicator. However, using 1

bit for the broadcast indicator requires a high power supply. Therefore, by transmitting the broadcast indicator using at least 2 bits, as shown in Figs. 6 and 7, lowers the power consumption and reduces an interruption factor.

Fig. 8 shows a portion of the expanded system parameter message field which additionally includes the QPCH\_BI\_SUPPORTED field and the broadcast index field (BCAST\_INDEX) of 3 bits according to the present invention.

According to the present transmitting and receiving method of short message broadcast services, the BS notifies to the MS, in advance, whether a transmission of broadcast message currently exists. Therefore, a MS need not unnecessarily and periodically monitor the common control channel (the paging channel or the broadcast channel) to receive a broadcast message from the BS, if there is no broadcast message. Thus, the present invention prevents a waste of power consumption by the MS and increases the efficiency of the short message broadcast services.

The foregoing embodiments are merely exemplary and are not to be construed as limiting the present invention. The present teachings can be readily applied to other types of apparatuses. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art.